

Optimisation of Public Building Projects in the Design Phase

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Abstract

Currently, as a result of the recession, governments are deeply involved in public investment projects to promote economic growth. Public building projects (museums, universities, theatres), compared with private investments, have a range of specialist requirements. Among others, public project should serve political, cultural, social and urban interests. In the preparation phase, those interests are dominant, and overall cost-efficiency is only a secondary level decision factor. However, this factor must be taken into account and together with all other requirements, is an essential part of the project design phase. This process must be a part of a well-established feedback mechanism, which incorporates public requirements, building cost calculation, and other decision making factors related to the public investment project.

A number of methods are well known for operational cost optimisation such as LCC analysis, Value Engineering, and benchmarking. After close investigation of the scientific literature, the author will describe potential organisational models, which incorporate evaluation and optimisation of building operational costs. The article suggests further research directions.

Keywords

Facility Management, operational cost, optimisation public building, public investment, project preparation

1 Introduction

The present article is about the preparation works of public investment projects and in particular, the organisational integration works that prepare for further operation and facility management.

Today, public investments are in increasing focus. Governments frequently choose to increase the volume of community investments as a tool of recovery from recession, whether it is the development of infrastructure or the construction of welfare facilities. Such public investments like hospitals, museums and stadiums have numerous special attributes where they differ from the business development of the private sector. Because of this distinctiveness, the preparation work for investments cannot be managed according to the usual business standards. There is no doubt that in the case of business targeted investments, even if it is as essential, the demand system of future facility management is not in focus. The still little known FM standard, EN 15221¹ places the financial budget in the middle of facility management planning. Essentially, such an approach corresponds with the business planning method. The 'business case' searches for the optimum of the overall all-time investment and facility management costs and the net present value (NPV) of future income. In the interest of reaching this optimum, the construction works are planned iteratively, decisions are made based on the concept of utilisation, and plans are made of the overheads cash-flow.

Initially, this paper reviews the literature on preparation works for the facility management of private investments. It then introduces the observations of certain studies already made during the elaboration of facility management for infrastructural public investments. It concludes with the steps for further research.

2 Public Investments

The method for preparing public investments does not necessarily match the procedures applied to investment works of the private sector. Jalocha (2014), in his article, asserts that a

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¹ The EN 15221 standard was started to be composed in 2002 and nowadays has seven sections which were launched between 2006 and 2011, that are obliged to apply in all member countries of the European Union.

project manager working in the public sector is supposed to have additional competencies over a project manager among market conditions. Undoubtedly, public investment players, sponsors and partners make their decisions according to complex criteria, meaning their actions are not only determined by the net present value criteria (degree of the profit). There has always been a debate on the measurement of value within the public sector, namely whether market value can be an unequivocal decision-making criteria, or, the investment decisions are to be made according to other forms of value such as utility, social compliance and aesthetic value. This question arose in the private sector only after the real estate market crisis, as discussed in the article of Oliomogbe (Oliomogbe et al., 2012).

In the community sphere, decisions are made by more people over a longer time period with a lower willingness for risk taking. As projects are financed from common funds, the control mechanisms and compliance with such principles are much more important. Specifically, certain public investments are commenced as a result of political motivations and aims; later, following the handover, the project sponsors consider the aims completed, and the maintenance and facility management becomes a nuisance. Rostás (Rostás, 2007), while describing the public investment system plan, finds that the specifics of common investments are realised not for financial considerations, but for social profit.

Naturally, public investments can be segmented, described by location, extent, function and many other factors compared to certain investments of the private sector.

This paper presents a model with two loops (Fig. 1) as a result of dividing the one-poled standard of EN 15221, focusing exclusively on the monetary resources, into two poles; while in the corporate sphere, the target system of FM can easily be defined as the leading service of main corporate processes. At the same time, in the public sector, the target system is complex and varies according to institutions. Therefore, in the opinion of the author, the target system and the resources are to be considered as the two different poles of the public operational model.

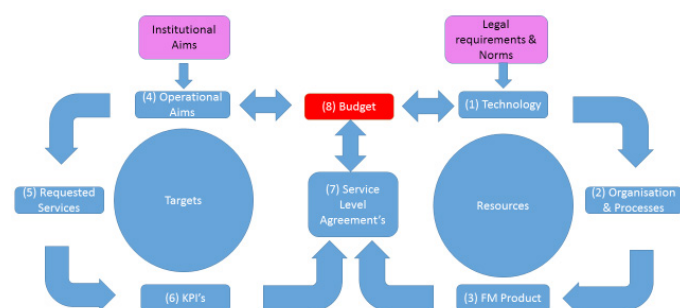


Fig. 1 Model of Public FM

We have to consider two main drivers outlined as the operating cycles, namely, the unity of institutional aims and the consequences determined by the law, rules, regulations and standards. The targets of operation are derived from the institutional aims. While the general aim (mission) of the institution is independent from operations, the targets of function are already part of the two-loop FM cycle being in a constant interaction with its elements. Another input point of the cycle is the system of legal requirements determining the resources of the real estate and built-in technical specifications. Public real estates have to satisfy all sorts of needs to which needs there are countless legal rules and regulations, standards, and demands based on customs. The buildings and the built-in technologies might be in compliance on different levels, which can also appear in the model as the variables of the FM loop-cycle. The cycle arrives at the determination of costs of the Service Level Agreement (SLA) on the side of the target system, starting from the principle of creating aims of function, beyond the adjustment of service levels and the relating expected output indicators. While on the resources side, it is from the direction of the processes built on technologies and from the relating organisation, arriving at the description of the product that becomes the input data of the SLA and the budget.

3 Preparing for facility management during the design process

It is a professional cliché that in the case of an average building, the initial investment costs make up 20% of the total life-cycle costs, while the remaining 80% are the total costs of maintenance during the existence of the building in question. This fact was called to experts' attention after the events of the real estate market, the recession and the following 'Seven Lean Years', and put the focus on the so-called 'total facilities management'. Zhen in his recent article (Zhen, 2015) notes the following of total FM: 'In the past several decades, the revolution of integrated lifecycle management of built assets has made facilities management (FM) one of the most fast-growing professions in the global construction industry with regard to clients' diverse needs and demands, ...'

Another new classical project management axiom is that the effectiveness of the investment project, namely the triumvirate of time – scope – budget is not the same as the measurement of project success. Serrador and colleagues (Serrador et al., 2014), examined 1386 projects after their completion and found that only 60% of the projects were 'effective' in the meaning of project management. Mainly, because good quality realisation is not a guarantee of effective and good functioning; it might not fully match with the demands of the end-user.

As mentioned in the introduction, the pre-planned assurance of effective operation has never been a primary consideration in private sector investments; facility management, in general, has never been in focus during the course of design. Scientific

research in this field has lived up as the question of sustainability has come into view, since increasingly more decisions on further utilisation have to be made during the planning works.

In many of his articles, Both (vide f.e. Both and Kohler, 2005) discusses the questions regarding the effects of the engineer's programme planning on the total life-cycle of the building. According to the author, the project can only meet with the highly complex sustainability requirements, if all expectations of all stakeholders are collected in a structured and detailed format. Both suggest a spatial data collection software for the survey of requirements. Vainer (Vanier, 2001), certified by statistics the well-known fact of the necessity of regular maintenance works, in order to keep the planned utilisation period.

Special buildings, as protected historical monuments, need careful monitoring system regarding their operation (Kutasi and Vidovszky, 2010)

Lu and his associates (Lu et al., 2004), in their article, call attention to the interest of providing sustainability; the functional, environmental and economic requirements of the full life-cycle are supposed to be integrated among the targets from the beginning of the planning process. Not only physical but life-cycle parameters need to be optimised. For this purpose, they worked out a model for the flow-based evaluation system, suggesting, that in the case of certain planning assignments, this approach is to be introduced in the early phases according to users' demands. The flowchart in Lu's article explains the process of the designers' feedback. (Fig. 2)

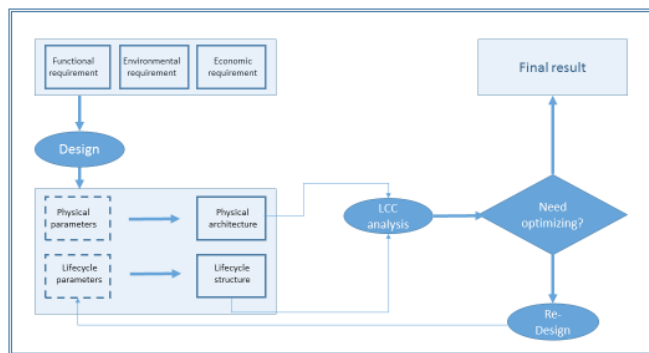


Fig. 2 Flowchart of Designer's feedback mechanism

4 Optimisation of the project

Every (private) investment is preceded with a business plan containing income and expenditure and their risks. The numbers of the business plan are suitable to determine the total costs, namely, the whole-life cost of the total establishment, considering the forecasts in respect of the whole-life period of the building. The ISO standard [BS ISO 15686-5:2008] discusses the buildings' life-cycle; Part 5 covers life-cycle planning. According to the BREEAM assessment method, the above standard is to be applied in the process of 'green' life-planning.

The first part of this mentioned standard introduces the so-called 'Factor Method'. Within this method, the average

expected lifetime is modified with factors like the quality of the components, the level of planning or the maintenance methods. Hoyde, in his article (Hoyde, 2002), discusses the practical utilisation of the theoretical environment of the standard, more specifically, he writes about the difficulties and states that the wider introduction can only happen in parallel with the broader spread of integrated life-cycle planning. Many models are suitable for the calculations of the life-cycle costs (LCC); Plebankiewicz and his partners examined the case studies in the scientific literature according to their chosen methods (Plebankiewicz et al., 2015). They stated that the differing results of the different methods is because the examined criteria are different, depending on the method, even if their aim is to calculate the LCC.

Kohler and his co-author suggest the early introduction of the integrated life-cycle model during the planning and preparation works in the interests of the higher success of green investments (Kohler and Lützkendorf, 2002). During their examinations, they illustrate the objective as a complex, 'n' dimension matrix of sources as input and planned emissions. For this purpose, they developed a program called 'LEGOE'. From the early runs, they realised that integration needs more time and claim, therefore, that they believed the spread of their approach would have taken approximately ten years. Unfortunately, today, we have to believe that the concept will be widely known only within another decade.

In 2011, Lizzarde and his counterparts still emphasised that within the acquisition processes of investments, the complexities of points of view and the organisation of the clients are regularly disregarded (Lizzarde et al., 2011). They suggest different organisational models that can be changed according to the inner power relations of the organisation of the client, according to the combination of the 'internal pressure group'.

Australian researchers investigated the collaborative efforts and issues that arise between designers and facility managers at the conceptual design phase (Wu and Lim, 2015). They found that the use of BIM, which should be a common platform for collaborative work, is still in its infancy.

5 Experiences in public investments

There is less discussion in the scientific literature on public investments as their investment preparation, their 'business plans', are prepared along with a complex target system (Rostás, 2007). The researchers completed the examination of less complicated, infrastructural investments, where the target system and the social utility are easily interpretable and can be matched with a one-dimension financial criterion. Mery and his colleagues, for example, developed a software environment for LCA-based optimisation of planning water treatment plants. (Mery et al., 2013). Bridges, as public investments, for instance, can be easily estimated from total maintenance costs. Safi, in his PhD thesis, presents which optimisation potentials stand for which preparation phases within the life-cost

planning (Safi, 2013). His table on bridge structures might be a good start in case of calculating a public investment project with more complicated targets. (Fig. 3).

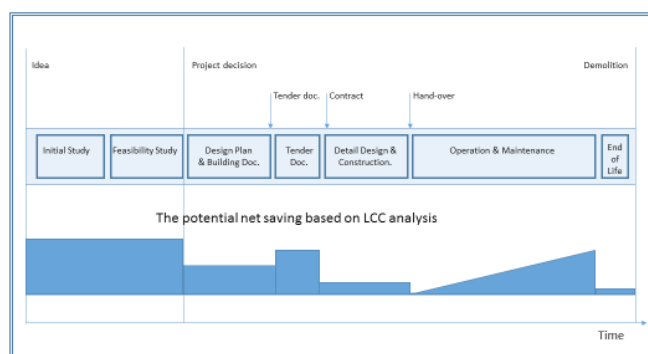


Fig. 3 Optimisation potentials in several preparation phases

The study of Perera also emphasises the necessity of LCC analysis in the case of public investments (Perera et al., 2009). Among more complex targeted projects, Lee and his colleagues (Lee et al., 2010) prepared the renovation alternatives of a museum. It was a one-dimension, cost based examination that analysed life-cycle costs. The case study, examining only economic points of view, highlights that in public investments, along with the cost dimension, the other dimensions of target implementations should be integrated into the procedure, such as visitor experience, public values or increasing knowledge capital.

6 Conclusion

A certain mutual learning process can be observed between private and public sectors. Within the public sector, the measurement of value has always been a discussion topic, namely, whether market value can be an unequivocal decision-making criterion. This question only arose among the private sector actors after the real estate recession, referred to by the article of Oliomogbe and others. Parallel to that, theoreticians of the public sector turn more and more towards economy-based decision making, within this, the complete life-cycle planning of investments, see the quoted references of Perera, Plebankiewicz, Mery, Safi and Lee.

This learning project in this present topic is to be continued. The already explored connexions of private investments are also to be transferred to the field of public investments. At the same time, we cannot disregard that the target criteria of public investments have multiple dimensions; even though cost analysis is very important among these dimensions, the net present value is not the sole decision-making criterion. There are a series of “switches” and all of them are important criteria. (Fig. 4)

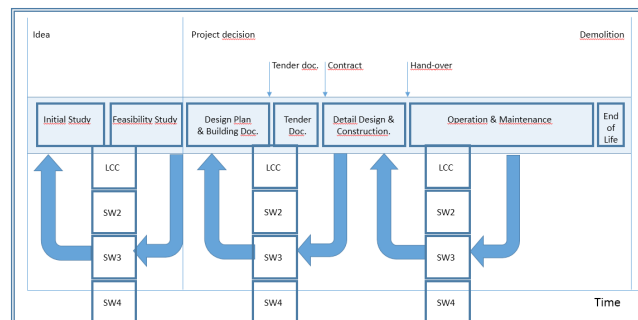


Fig. 4 Optimisation potentials in several preparation phases

As it is important with private investments, it is also important in the case of public investments that the preparation process is integrated phase by phase and the feedback is ensured in every phase.

Planning, calculating and feedback cycles in every step of the process of investment preparation works, helps to optimise the cash-flow. The author suggests that the research is extended in the interest of exploring the connections (switches) between the maintenance variables and the ‘values’ of the multi-dimensional target criteria.

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